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CENTRAL INTELLIGENCE AGENCY

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Annex

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To the Soviet Control Commission

Attention: Supervising Director of Construction

Mr. Derschawetz

Berlin-Oberschoeneweide

An der Wuhlheide 228/30

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Distribution Fe/Pa 92

Referring to our conversation, we herewith submit a bid for the construction of an electromagnetic radar ranging appar [redacted]

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I) Description of the construction as planned:

The apparatus is designed to safeguard vessels traveling in crowded or dangerous waters, for instance, when entering harbors in foggy weather, or when cruising in regions of drifting ice, or in shoal waters. The apparatus is electromagnetically operated and registers obstacles with respect to direction and distance in the horizontal plane.

The apparatus consists essentially of the following parts:

- a. The antenna, located at the top of the mast
- b. Controls with synchronizing device and visual apparatus, installed in the radio room
- c. Auxiliary visual apparatus, installed on the bridge
- d. Converter, installed in the converter (generator?) room
- e. Automatic north-seeking apparatus, normally installed in the center of the ship
- f. Stabilizer, also installed, if possible, in the center of the ship

Four sketches, attached only to the original of this report, contain the following diagrams:

SF - 504	General diagram of the installation,
SF - 503	Construction diagram of the installation,
KB/SG - 022	Diagram of the synchronizing device,
KB/SG - 021	Diagram of the stabilizer (artificial horizon) and synchronizing device.

The antenna is parabolic in type and rotates around its vertical axis. Because of the short wave lengths used, it is not advisable to use long cables for the high-frequency current because of attenuation. Therefore the transmitter with its center-tap key modulator circuit and the receiver input circuit is installed at the antenna, so that only low frequencies are received (through the cable). The antenna of the apparatus is rotated by a motor at a constant rate of 60 rpm. For purposes of synchronization, the motor also turns two (synchro) transmitter systems with rotation values of 360° and 10° per rotation. These are connected electrically with the receivers (synchrotransmitters) of the image reproduction apparatus (cathode-ray tube). The (synchro)transmission works on the transformer principle, that is to say, the field-vector resulting from a three-phase coil is

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transformed to the stationary field-vector of a single-phase exciter (magnetization) coil. The deflecting coils, arranged around the Braun tube, are rotated in the image reproducing apparatus by the 10° receiver (synchro) by way of a differential synchro. In order to obtain a simple transfer of the Braun tube (CRT) indication to the sea chart, the course value of the rotation coming from the receiver is superimposed by means of the differential synchro. For this purpose we included a coarse and fine servomechanism connected electrically with the transmitter of the gyrocompass. The adjustment is effected automatically by a control motor. A hand-operated wheel is also provided to set the course to zero. The current is to be furnished by a converter powered by the direct voltage of the ship's power supply, the generator of which furnishes single-phase alternating current of 500 cycles and 110 volts. The connecting wires run from the controls to the individual instruments.

It is advisable to stabilize the vertical antenna axis, since the rolling of the ship periodically interferes with the determination of obstacles to port and starboard, and the pitching with the determination of obstacles fore and aft, making them at times invisible. For stabilization, a mono-gyro compass, partly compensated for horizontal acceleration, has been planned. The rolling and pitching angles measured by the gyro pendulum are inductively compensated by control motors. At the same time, these motors operate the roll and pitch transmitters. The manual manipulation is planned to set the course to zero. The roll and pitch transmitters (synchro generators) are connected electrically with the corresponding receivers (followers or synchro motors) of the image scanning apparatus. The transmission works on the principle of a transformer, and for this purpose we use the change from the field-vector resulting from a three-phase coil to the stationary field-vector of a single-phase exciter coil. The roll and pitch receivers consist of coarse and fine systems, the latter being developed as power receivers, taking over the adjustment between parabolic antenna and UHF receiver and transmitter. The coarse systems automatically synchronize the image scanner and the gyrocompass. In order not to overload the power receivers (synchros), the point of gravity of the entire arrangement of the Cardan (universal) suspension is placed in the intersection of the Cardan axes.

II) Technical Data

- a. At an antenna height of 15 m above sea level with respect to a reflection plane of 0.5 m² also 15 m above sea level, the range is approximately 30 km.
- b. The angular resolution in the horizontal plane amounts to 3°.
- c. The distance resolution amounts to approximately 150 m beginning with a minimum distance of approximately 500 m.
- d. The rotational frequency of the antenna amounts to approximately 1 rpm.
- e. The diameter of the antenna unit which is approximately spherical amounts to approximately 1 - 1.5 m.
- f. The total weight of the antenna unit approximates 100 kg.
- g. The stabilization of the vertical axis of the antenna corrects the rolling motion within approximately 2° of the true vertical.
- h. The wavelength is approximately 3.2 cm. The transmitter uses a high-power magnetron and, on the receiver side, a 723AB klystron. Mixing takes place in a crystal diode. Cavity resonator tubes are used for high-frequency and oscillator circuits.

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i. Braun tubes are used for the visual presentation with a screen diameter of approximately 20 cm. The screen is fluorescent. Several auxiliary pieces of visual apparatus may be connected and installed wherever convenient. Range markers and the instantaneous ship's course can be imposed on the screen independently of other units. The chart can be adjusted by hand or automatically, in other words, the north-south direction may be made to coincide with the vertical of the visual screen.

j. The entire installation is operated from the ship's power network through transformers. Power consumption amounts to approximately 2 - 4 kw.

k. The measurements of the control unit are approximately:

width:	600 mm
height:	800 mm
depth:	300 mm
weight (approx.)	100 kg.

A check of supplies shows that at present a number of the following transmitter tubes are available at Oberspreewerke:

- | | |
|-----------------------------------|-----------------------|
| 1. Transmitter magnetron | for 3.2 cm wavelength |
| 2. Nullodes (T-R tubes) | " 3.2 cm " |
| 3. Receiver klystron 723 AB | " 3.2 cm " |
| 4. Modulation tubes 5 D 21 | |
| 5. Detectors for the mixer stage. | |

With these tubes it will be possible to build an instrument resembling the American "Meddo" ("Meadow" code name?) apparatus. Books regarding "Meddo" may be had from McGraw-Hill, New York, and should be bought (cost approximately 200 dollars). We know also that Major Schupke of MSP had in his possession during the years 1946-1949 photostatic copies of the 3 cm "Meddo" instrument from a report of the former German commission for captured enemy materiel (Beute-Kommission). These data should be valuable in assisting us in drawing up the plans. If no such data can be had, an intensive training course for the necessary personnel should be developed.

In the following paragraphs expenditure estimates have been based on the assumption that at least the "Meddo" reports are available, so that all that has to be done is to convert the instrument built for aircraft to an instrument adapted for use on ships. At the same time, conversion to other tubes must be investigated. Since the above-mentioned "Meddo" report does not contain any construction details, and some of the dimensions of the units are missing, it will be necessary to do a great deal of reconstruction and testing of the entire instrument. It will also be necessary to build the needed measuring instruments according to the data on hand, or to buy some of them in the foreign market. The data for the stabilization of the antenna and the automatic north seeking adjustment have been kept separate because they belong in different departments (Ships Apparatus Division) (Abteilung Schiffsgerate).

The following is approximately the course that should be followed: As soon as the contract has been assigned, the various group leaders should be acquainted with the task before them as a whole. Each one should be assigned part of the task, so that he can work out the details. After these plans have been completed, they are to be turned over to the division of designs (Konstruktionsbüro) which will furnish the experimental shops with sketches. As soon as the individual parts have been built, the units must be tested. After these tests are over, the individual units are to be assembled into groups and tested again until the entire instrument has been assembled and works satisfactorily. Detailed construction data now must be issued accordance to which a model will be built. After this model has been tested and perfected, the final plans are drawn up and the instrument is ready to be manufactured.

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While the above work is going on, special testing and measuring instruments will have to be constructed, since they must be available at the time the model is ready for testing.

We estimate the cost for the development of a sounding instrument, including construction of the model and preliminary testing as follows:

- | | |
|--------------------------------------|-----------------|
| a. without stabilizer, approximately | DM 1,400,000.00 |
| b. with stabilizer, " " | DM 1,600,000.00 |

Included in these amounts are approximately DM 10,000 for necessary expenditures in West marks.

We estimate that the work, given the present working conditions, will take approximately 25 - 30 months.

It will be necessary that extra specialists with various skills be added to those now available.

We estimate that the cost for the building and the testing of 10 further instruments (rader units) will be:

- | | |
|--------------------------------------|------------------|
| a. without stabilizer, approximately | DM 250,000. each |
| b. with stabilizer, " " | DM 300,000. " |

The 10 additional instruments cannot be built until after the model instrument has been built and tested. A period of 12 - 15 months should suffice.

We hope that this will give you the requested information and look forward to a favorable reply.

R - F - T

Central Laboratories for Signal and

Special Apparatus V E B

signed: Paulussen signed: Boer

4 sketches attached
only to the original
of this report."

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